# Exam 2

**Math 0220** (evening) **Spring 2011**

100 points total **Student's name:** _____

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1. [10 points] Use a linear approximation to estimate $\frac{1}{1001}$.

2. [15 points] The half-life of cesium-137 is 30 years. Suppose you have a 300-mg sample. After how long will only 2 mg remain?

3. Find derivatives of the given functions.

(a) [6 points] $f(\theta) = \ln(2\sin\theta)$

(b) [6 points] $y = 3^{\cos(\pi x)}$

(c) [6 points] $y = x^{\ln x}$

4. For the function $f(x) = \dfrac{2x^2}{x^2+3}$

(a) [5 points] Find the intervals on which $f$ is increasing or decreasing.

(b) [5 points] Find the local maximum and minimum values of $f$.

(c) [5 points] Find the intervals of concavity and the inflection points.

5. The function $f = (x^2 - 1)^3$ is defined on the interval $[-1, 2]$.

(a) [5 points] Explain why the function attains its absolute maximum and absolute minimum values on the given interval.

(b) [10 points] Find the absolute maximum and the absolute minimum values of $f$ on the interval.

6. For each limit define the type of indeterminate form [1 point]. Them find the limit [5 points].

(a) [6 points] $\lim_{x \to -\infty} x^2 \, e^x$

(b) [6 points] $\lim_{x \to 0} (1 - 2x)^{1/x}$

7. [15 points] Verify that the function $f(x) = x^3 + x - 1$ satisfies the hypotheses of the Mean Value Theorem on the interval $[0, 2]$. Then find all numbers $c$ that satisfy the conclusion of the Mean Value Theorem.

Bonus problem. [10 points extra] Find the exact value of the expression $2^{3\log_2 3} + \tan(\sin^{-1}\frac{1}{2})$.